Preliminary Evaluation of Log Data in the Vicinity of Tank U-107

Letter Report

Author: Paul Henwood
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Purpose and Scope:

This report provides a brief summary of available geophysical logging data in the vicinity of tank U-107 (U Tank Farm) as of July 2001. It also provides recommendations for future work to investigate continuing contaminant migration and to assess the impact of waste retrieval operations in tank U-107.

Introduction:

Geophysical logging was conducted in the U Tank Farm during June and July 2001. Logging was conducted according to a strategy developed in the *Hanford Tank Farms Vadose Zone Monitoring Project Baseline Monitoring Plan* (DOE 2001) and in response to a special request to monitor boreholes in the area of tank U-107 in support of waste retrieval operations.

The purpose of the Hanford Tank Farms Vadose Zone Monitoring Project (VZMP) is to periodically monitor vadose zone gamma activity in selected depth intervals within existing monitoring boreholes adjacent to single-shell tanks. Gamma activity is compared to activity detected during the baseline characterization of the same boreholes conducted between 1995 and 2000 to detect any changes. Monitoring frequency is determined on the basis of existing contamination levels, plume behavior, tank characteristics, and tank farm operational requirements. This routine monitoring is conducted using a thallium-activated sodium-iodide (NaI[Tl]) detection system referred to as the Radionuclide Assessment System (RAS). Additional characterization may be required in selected boreholes using germanium detection systems that were used to develop the baseline characterization of the tank farm boreholes. These systems are referred to as the Spectral Gamma Logging System (SGLS) and High Rate Logging System (HRLS).

The special request was prompted by findings of the baseline characterization where the SGLS data indicated a processed uranium contaminant plume in the vicinity of tanks U-104 and U-107 may be continuing to migrate. Because it had been two years since the last log data were collected in boreholes in the area of the plume, it was deemed necessary to document any changes in the contaminant levels prior to the initiation of waste retrieval operations in tank U-107. To accomplish this task, a combination of logging using the RAS and SGLS was performed in specified boreholes. All boreholes in the vicinity of tank U-107 were logged with the RAS to provide a basis against which subsequent RAS logs can be compared to detect future

contaminant movement. In addition, selected borehole intervals on the north side of tank U-107 were relogged with the SGLS to detect changes in the baseline indicative of ongoing movement. Sufficient data would then be collected using the RAS during and after waste retrieval to attempt to segregate any increases in contaminants that may be related to retrieval operations from increases that have occurred from past waste releases associated with tank U-104.

The purpose of this preliminary data report is to summarize vadose zone data collected in the vicinity of tank U-107 up to July 2001, and provide recommendations for future logging in the U Tank Farm as it relates to the routine monitoring and the special request logging. A final data report containing a complete analysis and interpretation will be provided after waste retrieval operations and follow up logging have been completed.

Summary of Available Data:

Table 1 and Figure 1 summarize data collection activities in U Tank Farm during June and July 2001 in support of the routine VZMP and the special request.

Table 1. Summary of Borehole Data Collected in the U Tank Farm During July 2001

Borehole	SGLS Data		Score	RAS Data		Next Log Date	Comments
	Interval (ft)	Date		Interval (ft)	Date		
60-07-01	0-98.5	11/95	88	40-98.5	06/01	10/01	Special study; movement detected
	20-93	05/99					
	50-85	07/01					
60-07-02	0-126	11/95	56	35-100	06/01	10/01	Special study
60-10-01	0-125.5	11/95	16	40-60	06/01	10/01	Special study
60-10-11	0-98.5	11/95	16	40-60	06/01	10/01	Special study
60-08-04	0-127.5	11/95	57	35-100	06/01	10/01	Special study
	50-70	04/99					
60-07-10	0-98.5	11/95	88	40-98.5	06/01	10/01	Special study; movement detected
	50-80	04/99					
	20-98.5	07/01					
60-07-11	0-124	11/95	88	40-100	06/01	10/01	Special study; movement detected
	50-95	05/99					
	20-102	07/01					
60-04-03	0-125.5	09/95	44	35-75	07/01	06/06	
60-04-08	0-118.5	09/95	82	40-90	07/01	10/01	Movement detected
	50-85	04/99					
60-04-10	0-118	09/95	69	35-90	07/01	07/02	
60-04-12	0-125	09/95	44	35-75	07/01	06/06	
60-05-04	0-72.5	10/95	49	35-72.5	07/01	10/01	Near movement
60-05-05	0-123.5	05/96	49	35-75	07/01	07/02	
60-10-07	0-121	12/95	41	35-75	07/01	07/02	
	51-59	12/99					

Most of the boreholes logged would have been selected using the monitoring plan selection criteria (DOE 2001), where the total score is used to prioritize boreholes. The total score is derived on the basis of borehole and plume characteristics, proximity of a borehole to a suspected leaking tank, and on the volume of drainable liquid currently stored in a tank. The total score is a relative measure of the overall likelihood for measurements to detect movement in the vadose zone. Boreholes with total scores in excess of 37 were selected for routine monitoring during calendar year 2001. In five cases a borehole selected for routine monitoring was also designated for logging as a result of the special study request. Two boreholes were logged for the special request even though the total score was low and would not have been scheduled for logging until the following year.

All boreholes were logged using the RAS and three boreholes were also logged with the SGLS. Four boreholes indicated apparent changes. Measurements with the SGLS in boreholes 60-07-01, 60-07-10, and 60-07-11 corroborated continued change as suggested in the U Tank Farm addendum (DOE 2000), where 1999 measurements showed intervals of uranium-238 (^{238}U) and uranium-235 (^{235}U) contamination extending to greater depths than in the 1995 baseline. The 2001 SGLS and RAS measurements for these three boreholes shown in Figures 2-4 suggest continuing downward contaminant migration.

Borehole 60-04-08 was selected for routine monitoring with the RAS but was not included in the special study. Total gamma measurements in this borehole indicate the possibility of movement relative to the 1995 baseline SGLS total gamma (Figure 5). The 1999 SGLS measurements did not extend deep enough to detect potential contaminant migration. This borehole was not logged with the SGLS in 2001.

Randall and Price (2001) provided a summary of historical gross gamma ray data collected in U Tank Farm boreholes for the purpose of determining trends of gamma activity over time. Of the boreholes included in Table 1, only data acquired from borehole 60-07-11 indicate current instability; the instability is shown for a depth interval from 48 to 94 ft. The historical data and the methodology used to evaluate activity in the boreholes are not sufficient to detect movement for low levels of observed contamination.

Conclusions:

Preliminary evaluation of data suggest the following:

- Observed contaminant migration is not related to ongoing work in tank U-107.
- Downward migration of ^{238}U and ^{235}U contamination has occurred since at least 1995.
- Contamination is probably related to a known leak from tank U-104.

Recommendations:

Figure 6 summarizes all RAS data collected for the special request investigation and shows the intervals of potential contaminant movement on the basis of SGLS comparisons or in the case of borehole 60-04-08, on the basis of an SGLS/RAS comparison. Future logging in the U Tank Farm will be conducted with the RAS and direct comparisons will be made using the total gamma count rate.

It is recommended that all seven boreholes selected for special study be placed on a routine quarterly logging frequency using the RAS. This logging will be coordinated with CHG to avoid interference with waste retrieval operations. In addition, boreholes 60-04-08 and 60-05-04 should be added to the special study boreholes and be logged quarterly with the RAS. The remainder of boreholes shown in Table 1 will be logged with a frequency consistent with the strategy set forth in the baseline monitoring plan (DOE 2001).

In addition to the special request boreholes scheduled for logging, boreholes 60-11-07, 60-11-12, and 60-12-01 will also be logged during October 2001 for purposes of routine monitoring unrelated to the special request.

The historical gross gamma data from selected boreholes should be evaluated in further detail to identify the time of initial contaminant movement.

Neutron moisture logging should be implemented in boreholes associated with the special request because moisture is the most likely driving mechanism for contaminant migration.

References:

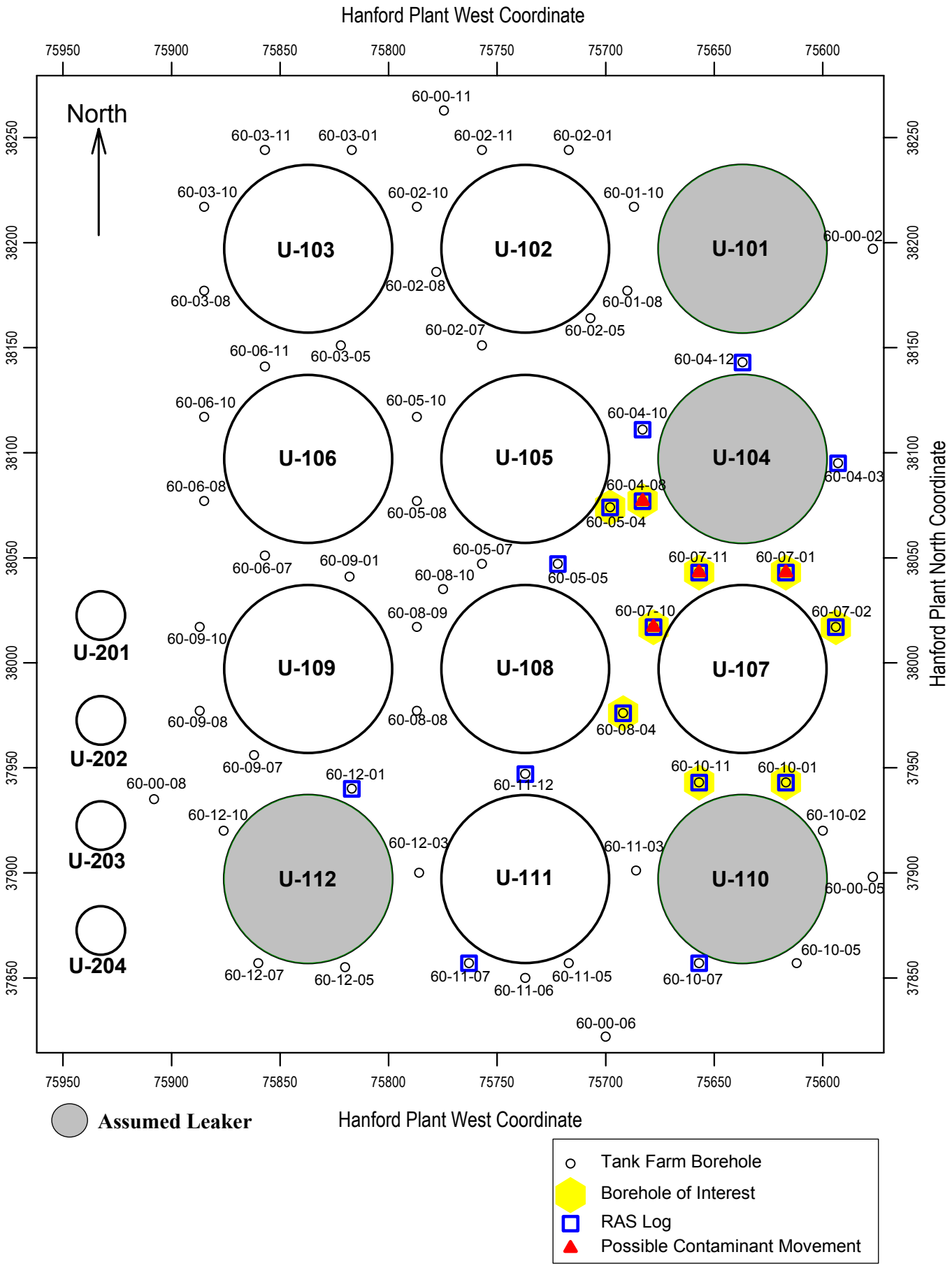
McCain, R.G., 2001. Letter to D. Baide, CH2M Hill Hanford Group (CHG), Subject: "Geophysical Logging in Support of Waste Retrieval at Tank U-107," April 24, 2001, MACTEC-ERS, Richland, Washington.

Randall, R., and R. Price, 2001. *Analysis and Summary Report of Historical Dry Well Gamma Logs for the 241-U Tank Farm-200 West,* RPP-7729, Rev. 0, prepared by Three Rivers Scientific, Richland, Washington.

U.S. Department of Energy (DOE), 1996. *Vadose Zone Characterization Project at the Hanford Tank Farms, Tank Summary Data Report for Tank U-107*, GJ-HAN-36, prepared by Rust Geotech for the Grand Junction Projects Office, Grand Junction, Colorado.

_____, 2000. *Hanford Tank Farms Vadose Zone, Addendum to the U Tank Farm Report,* GJO-97-1-TARA, GJO-HAN-8, prepared by MACTEC-ERS for the Grand Junction Office, Grand Junction, Colorado.

U.S. Department of Energy (DOE), 2001. *Hanford Tank Farms Vadose Zone Monitoring Project*, *Baseline Monitoring Plan,* MAC-HGLP 1.8.1, Revision 0, prepared by MACTEC-ERS for the Grand Junction Office, Grand Junction, Colorado.


Hanford Plant West Coordinate
75950
75900
75850
75800
75750
75700
75650
75600
North
38250
38200
38150
38100
38050
38000
37950
37900
37850
Hanford Plant North Coordinate
60-00-11
60-03-11
60-03-01
60-02-11
60-02-01
60-03-10
60-02-10
60-01-10
60-00-02
60-03-08
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60-10-05
60-00-06
U-103
U-102
U-101
U-106
U-105
U-104
U-109
U-108
U-107
U-112
U-111
U-110
U-201
U-202
U-203
U-204
Assumed Leaker
Hanford Plant West Coordinate
Tank Farm Borehole
Borehole of Interest
RAS Log
Possible Contaminant Movement

Figure 1

60-07-01
Comparison of SGLS and RAS Data

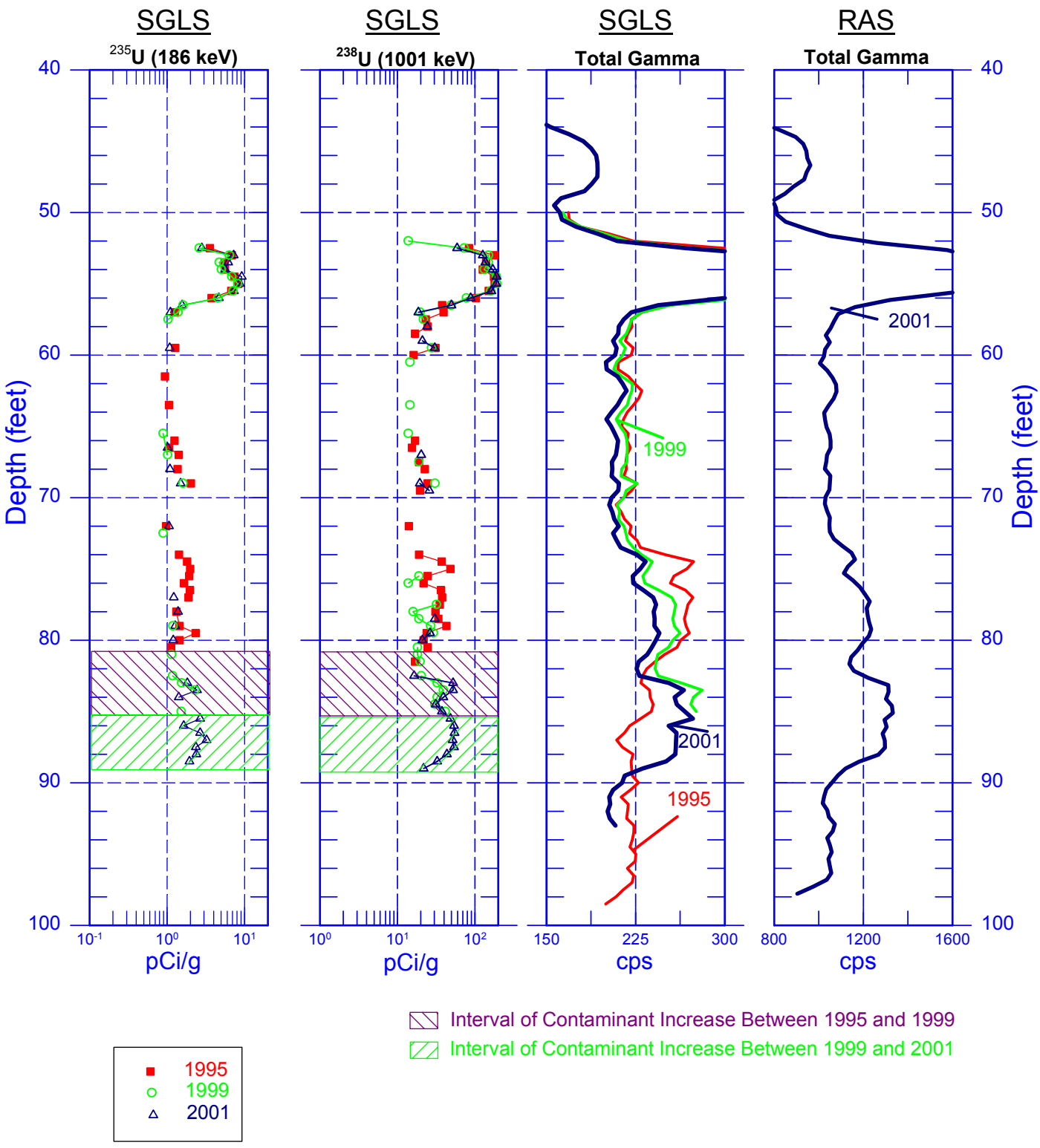

Figure 2

60-07-10
Comparison of SGLS and RAS Data

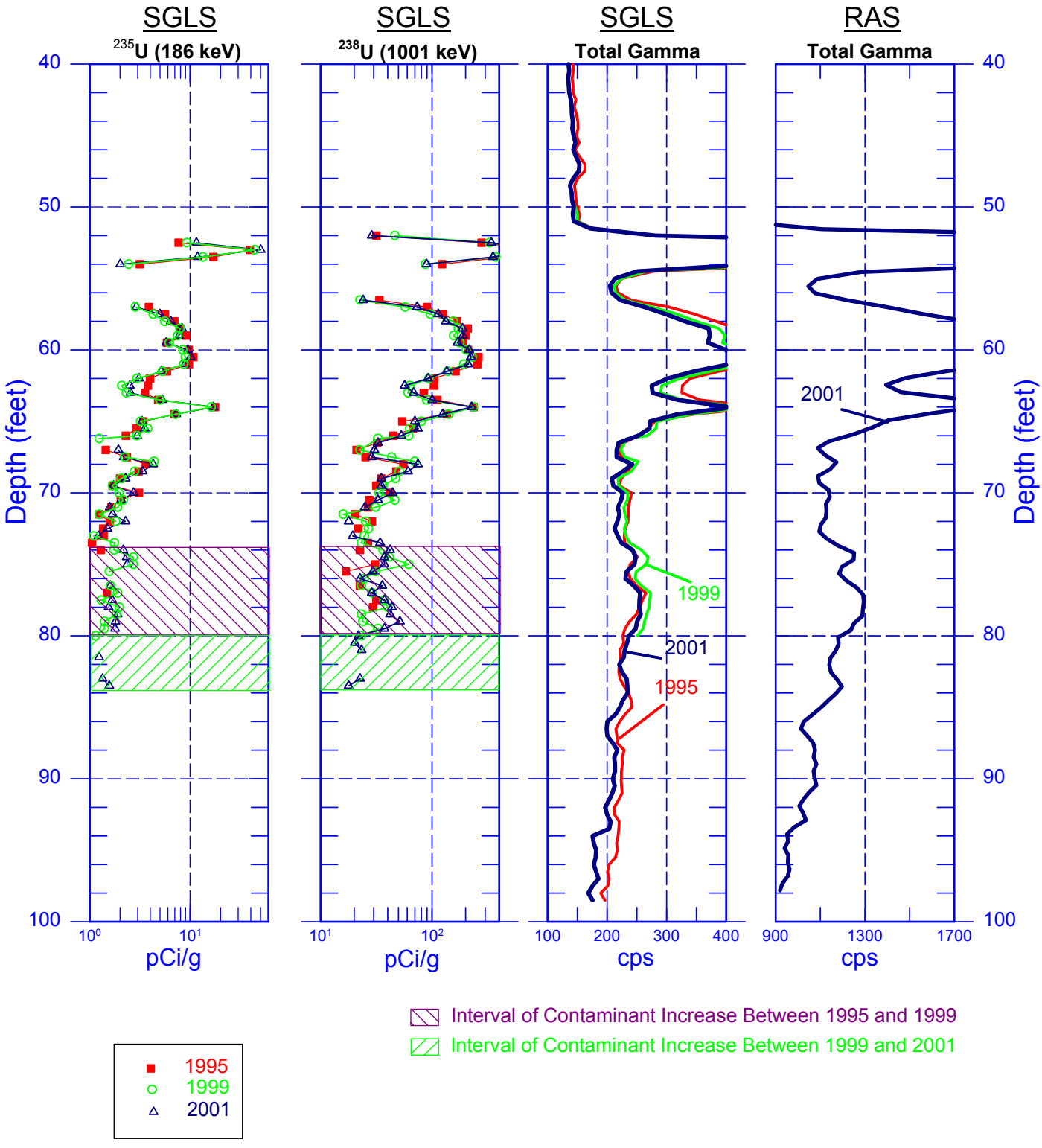

Figure 3

60-07-11
Comparison of SGLS and RAS Data

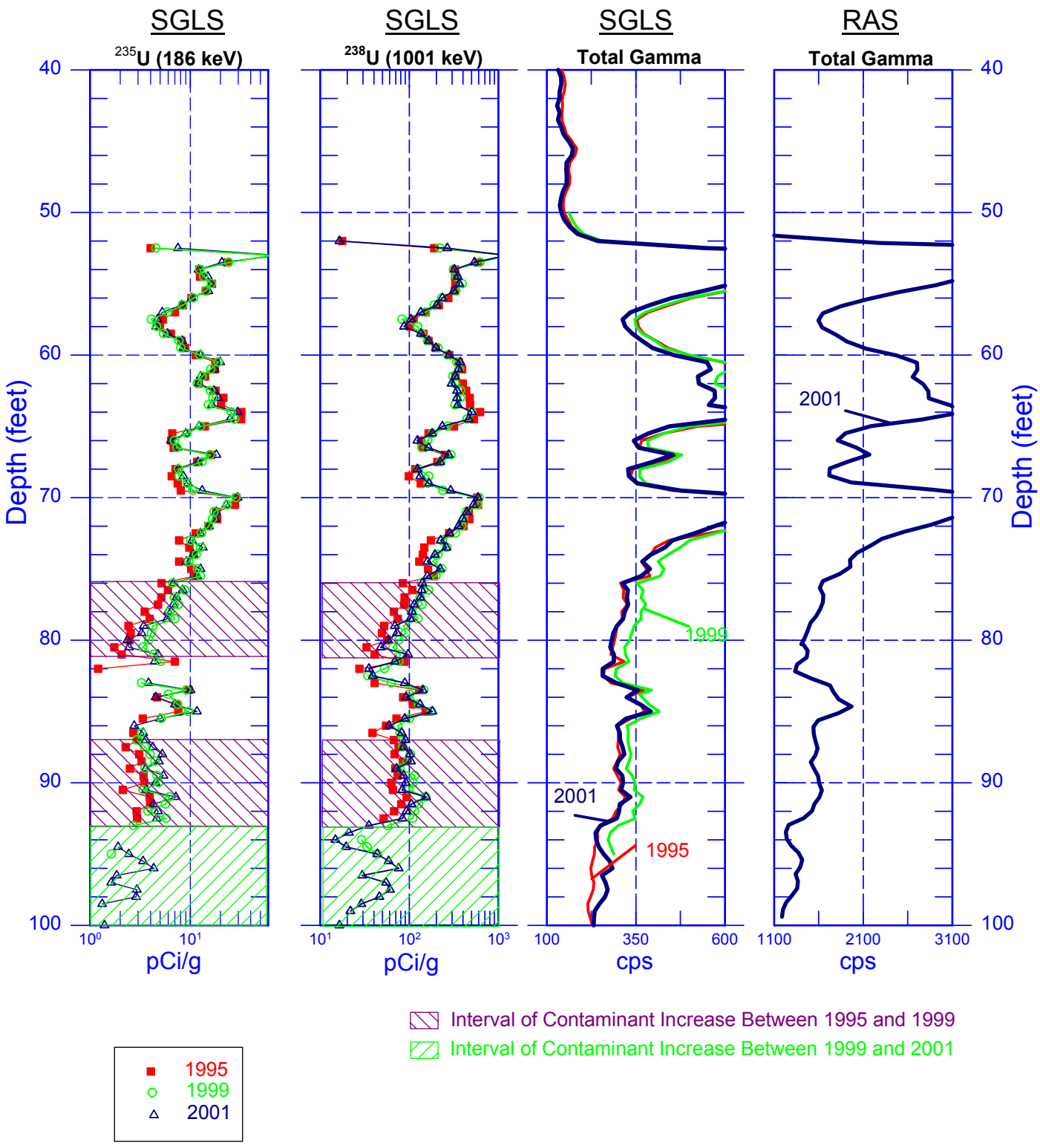

Figure 4

60-04-08
Comparison of SGLS and RAS Data

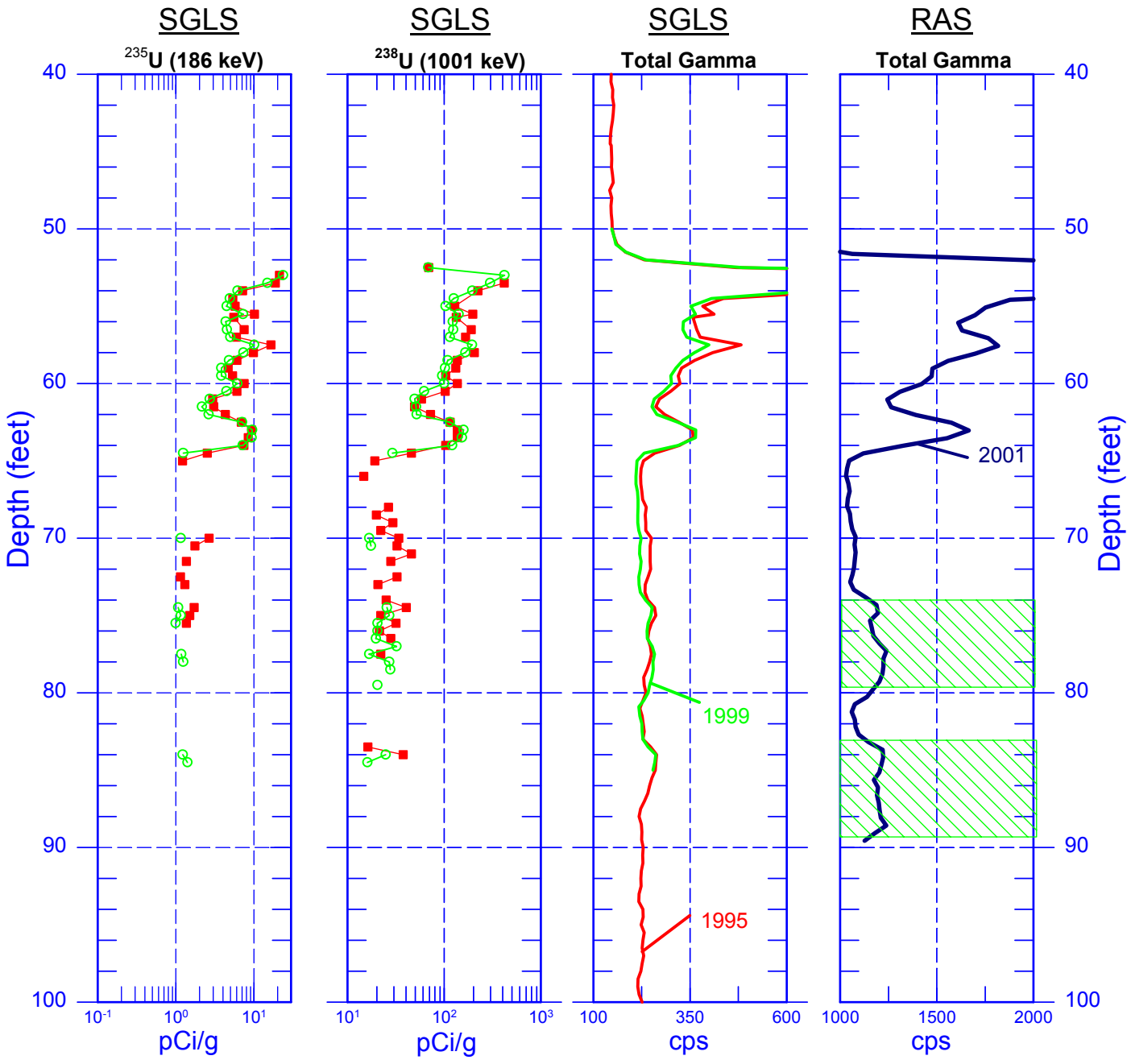

Figure 5

Summary of RAS Gross Gamma Data

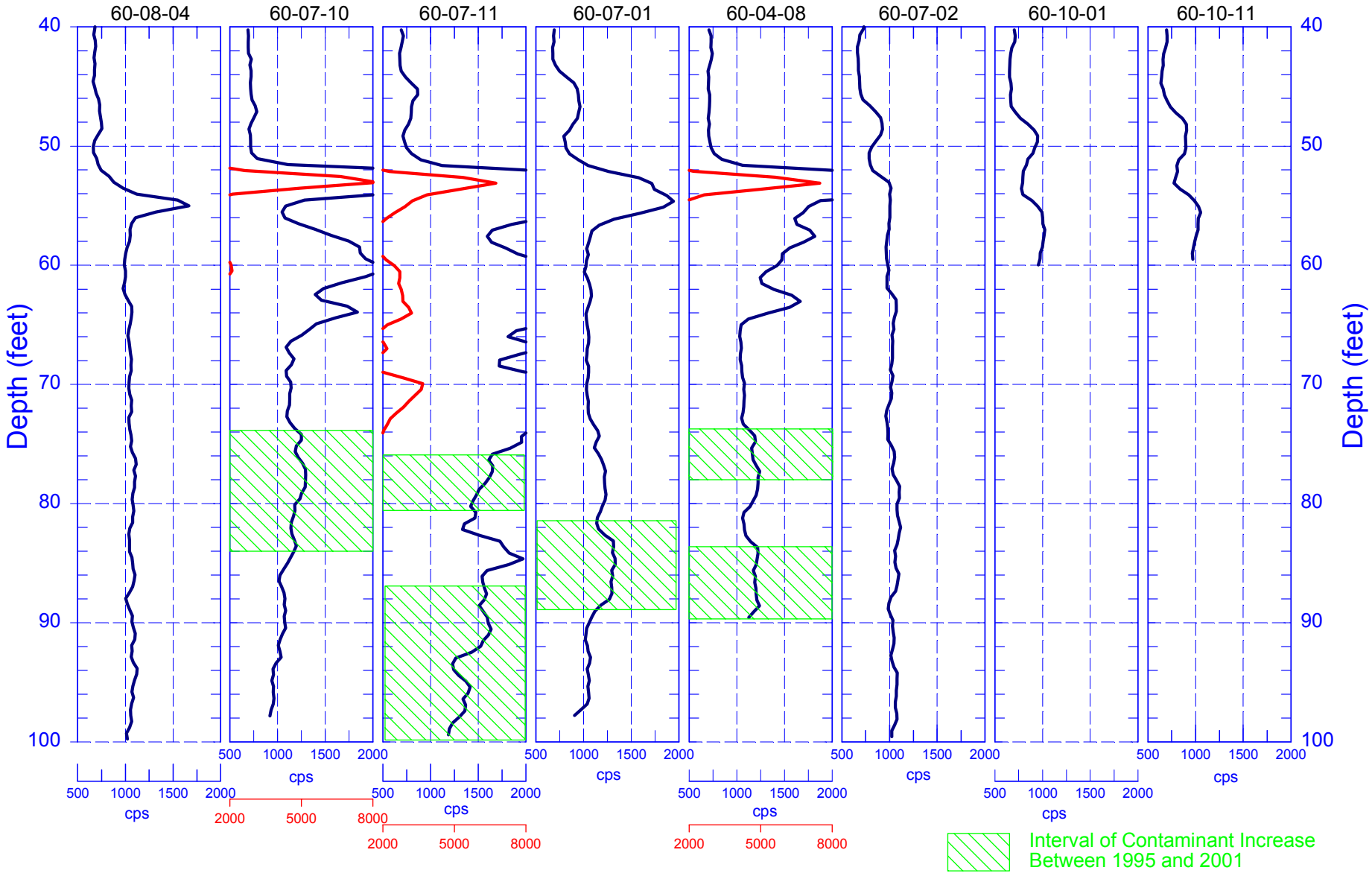

Figure 6